Setting, Verification, and Commissioning

1. Tools Checklist

Battery tools are not specified here.

Bring all tools for to work on battery post, re-torque, and measure strap resistance after torquing.

Arrange temporary battery if required.

Item	Cat#	Name	Check
DTU Setting and Data Collect			
1		Laptop with 1) BatteryDAQ software package installed (IpSetup.exe) 2) pdf printing	☐
2		RJ45 Coupler (connect RJ45 to cable on fiber unit)	☐
3		12V power adapter for test (during installation, before unit is powered by battery)	☐
4		AC Power extension cord (25FT)	☐
5		Mini travel router (ZyXEL or ELECOM) with 4P power cable (Optional, **Cool to have**.) (*Wi-Fi router enables cell phone connection to view data and progress while you are wiring to the batteries, correct wrong wiring as you go*.)	☐
6		Ethernet cable (Laptop can connect to DTU directly without going through router.)	☐
7		USB to serial cable (debug DTU if it is not working properly)	☐
8		90-degree angled DB9 adapter (debug DTU without taking off from enclosure)	☐
9			
Calibration			
11	Fluke 287	**Fluke 287** (strongly recommended) multimeter (0.001mV resolution for shunt offset calibration, AA x 6 spare batteries) Ordering link: https://www.acmetools.com/true-rms-electronics-logging-multimeter-fluke-287/095969369930.html	☐
12	80BK-A	Temperature probe for Fluke meter	☐
13			☐

2. Data Review Checklist

Item	Description	Check
1	**Battery number and Section must be set correctly.** Default 60x2V, Section as 15+15+15+15 For 58x2V, shall set Section as 15+14+14+15	☐
2	Shunt CT (or Hall CT) offset/zero has been calibrated. Floating current is correct.	☐
3	Temperature offsets are calibrated.	☐
4	All cells show correct voltage/IR/CR data. Bar graph has been snipped and recorded.	☐
5	Cells with IR lead show normal IR value	☐
6	Inter-tier Connection(s) value is correct	☐
7	Sentry unit Cell and String Voltage High/Low alarm setting Sentry unit IR High/Low alarm setting Sentry unit CR alarm setting (Inter-tier High) Sentry unit Temperature High alarm setting	☐
8	DTU firmware has been updated.	☐
9	DTU date/time is correct.	☐
10	DTU IP Address setting For managed cellular connection, set to dynamic IP (all 0.0.0.0) to accept assigned IP by cellular modem. For fiber connection, set to assigned static IP. If it is not networked, set to dynamic IP for auto-IP, all 0.0.0.0	☐

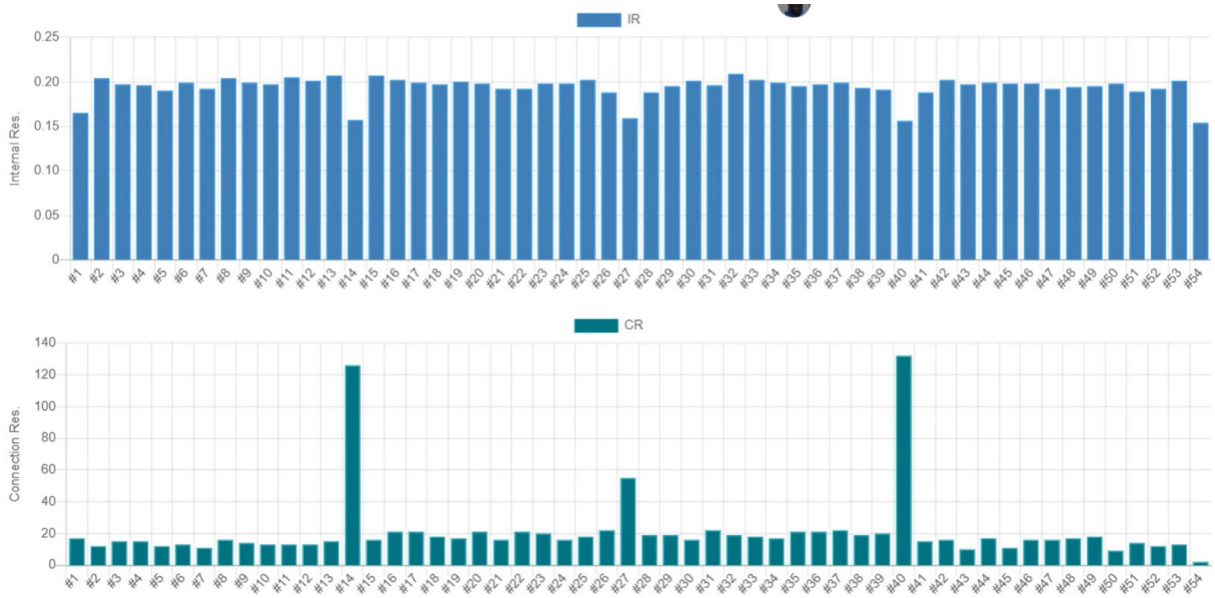
3. Common Errors and Alarms

After powering on the unit with battery connection cable, check data via laptop.

	Error	Correction
1	Battery voltage reversed	Swap leads [taking off and swapping the two fuse holders for that cell]
2	Battery voltage low or zero	The wire is not connected to the cell, or 0.5A fuse is not in place. Measure voltage from the terminal plug to verify voltage presence. If voltage is on the terminal, it is possible to have a PCB fault. Replace with a spare PCB to verify.
3	Battery voltage high	Wrong connection, measure from terminal plug to verify.
4	Internal resistance low for a section	RM leads are not connected or 10A fuse burned.
5	Internal resistance low for a cell or cells with IR leads	RM leads are not in correct location (Refer to 3.1 for troubleshooting)
6	Extreme CR (>500 micro-ohm)	Check wiring on cable and adjacent batteries, may have been swapped or connected to wrong cell.
7	Temperature very high	Temperature probe has short circuit or reversed. Open a T+ or T- wire from terminal plug, if the temperature goes to very low, then replace the probe.
8	Temperature very low	The temperature probe is open. Connect the probe directly to the terminal plug, if temperature comes back to normal, then check the wiring.
9	Current very high or low	Measure from CT 4-Pin terminal to verify power supply (+12V, -12V and SGND) connection. Also, measure IS on terminal which is around zero. Mostly, it is the wrong wiring for the power supply.
10	Service alarm but all data seems ok	DAQ → Settings → System Setting, page to Temperature calibration, check pilot#1 and pilot#2 reading, you may find one probe has very low T reading. Check connection or replace probe. [Pilot temperature displays the higher value of two probes, so you won't see the fault from main page T reading.]

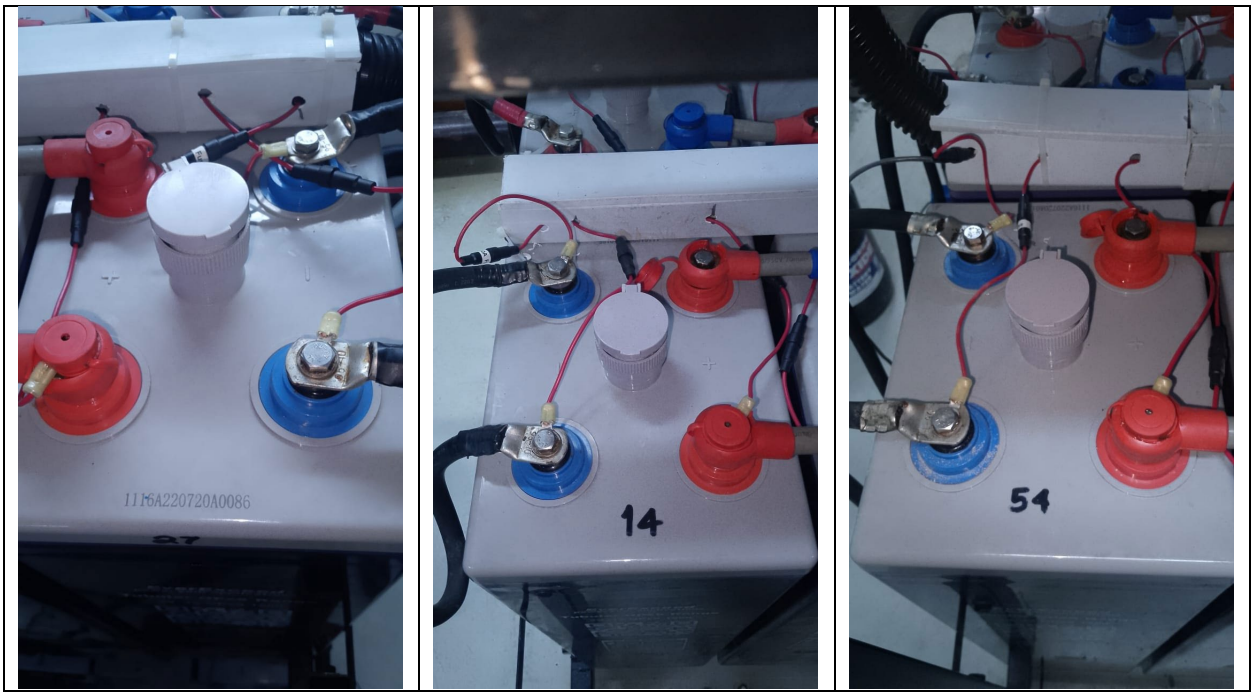
3.1 IR Accuracy Example 1

Battery: 54x2V, 2 sets of posts on each cell.



Cell #1, #14, #27, #40, and #54 have abnormal lower internal resistance reading.

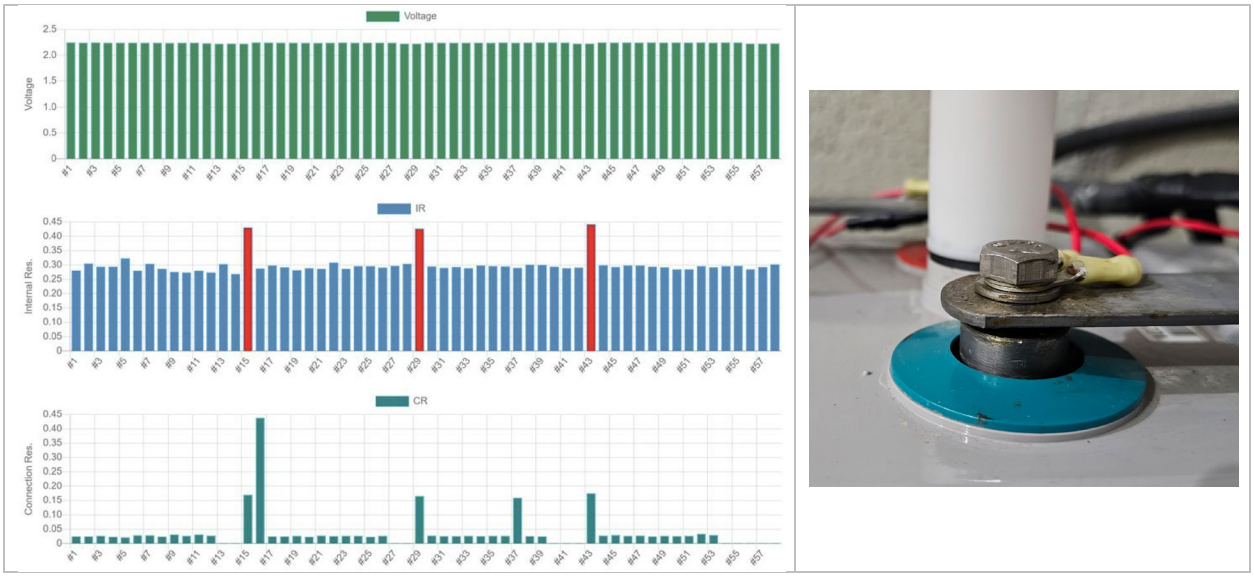
Reason: not an ideal Four-Terminal measurement. There is significant resistance between two posts.



Correction: relocating IR leads to on top of sensing leads.

3.2 IR Accuracy Example 2

Battery: 58x2V, single set of post



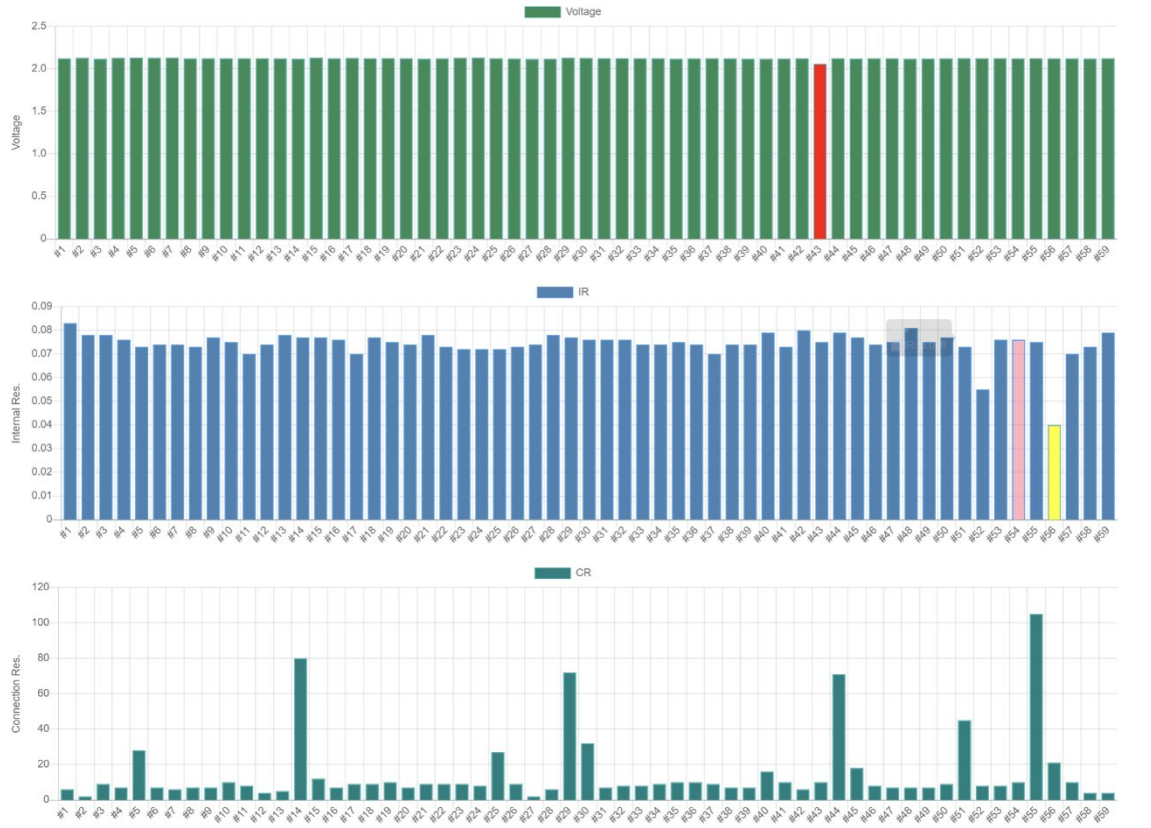
Cell #15, #29, #43 have abnormal internal resistance reading, also connection resistance higher.

Reason: on the post with both IR lead and sensing lead, there is stainless steel washer between sensing lead and cell connection.

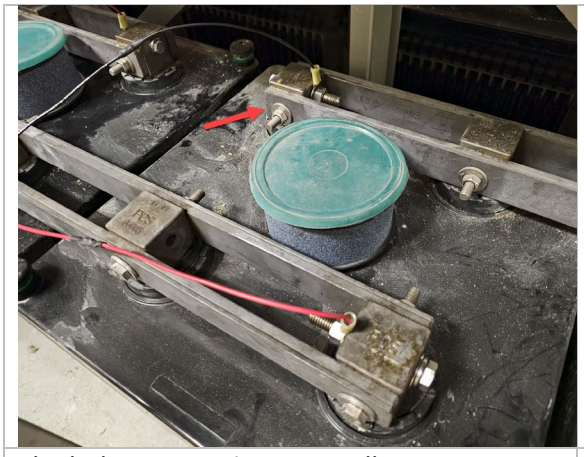
Correction: move the washer to the top of leads. [Do not need any correction for the post with only sensing lead.]

3.3 IR Accuracy Example 3

For some installations with “wired” IR reading, that might be caused by battery connection issues. Follow the CR reading, check the connections first.



Cell #52 and #56 have abnormally low IR reading. At the same time, the CR reading on #51 and #55 are higher.

	
The bolt was not tigten on cell #52.	Corrosion was discovered on #55.

4. Calibration with HMI

Unit has been calibrated in factory. It is necessary to verify the accuracy and re-calibrate in case sensor(s) changes or higher accuracy of IR/CR is desired.

4.1 Voltage calibration

Voltage has been calibrated in the factory. In case need to recalibrate, use Fluke 87 or 287 meter to measure the string voltage from battery plate (or 4 terminal power plugs on the Sentry unit).

Make sure all channels have correct voltage before calibration.

New Gain = Actual voltage / display voltage x previous Gain
New gain shall be close to previous gain.

4.2 Temperature calibration

Temperature offset does need to be calibrated for installed sensors.

Measure room temperature and battery temperature with Fluke meter (with K type probe).

Calibrate offset for TS0, TS1 and TS2

4.3 Current offset calibration

For Hall CT, unscrew one side, twist the CT, move out of battery loop for zero calibration.

For shunt CT, measure the actual current on shunt with high resolution mV reading with Fluke-287.

Shunt resistance = **0.175** milliohm. Amp = readout (mV) / 0.175, example 0.10mV → 0.57A

4.4 IR calibration

IR value can be calibrated to client's preferred/certified handheld meter.

Calibration can be done with battery online. (Off-line measurement does not include the charge effect. Calibration shall be done online with charger.)

1) Choose the cells without IR lead connection for comparison.
2) For 48V system, choose 4 cells to measure Internal Resistance with handheld meter.
3) For 125V system, choose 10 cells to measure Internal Resistance with handheld meter.
4) Calculate average readout with handheld.
5) Read out average IR from DTU. (Update DTU firmware to display average IR.)
6) New IR gain = Handheld Average / Sentry Average X IR gain.
   Example, handheld average 450 micro / Sentry average 420 micro x gain 260 = 278.
7) Use HMI to update the IR gain, save settings.
8) Wait for a cycle of measurement, verify the new reading. Shall be within 5% range.

Reading may not be exactly same with data from other commercial impedance/internal resistance reader because of different measurement method.

5. Alarm Settings with HMI

Alarm thresholds on Sentry unit can be adjusted with HMI.

DAQ → SETTING → SET ALARM → Page through

[Threshold values shall match actual battery capacity and condition, or determined by battery subject matter expert.]

	Parameter	Settings	Check
1	**Cell Float Voltage**	Cell Float Voltage High **2.450**V Cell Float Voltage Low **2.100**V	
2	**Cell Discharge Voltage**	Cell Discharge Voltage Low default **1.800**V (leave it as default)	
3	**Cell Internal Resistance**	Cell IR High **1,500** micro-ohm Cell IR Low default **50** micro-ohm (leave it as default)	
4	**Cell Strap Resistance**	Cell Connection Resistance High **500** micro-ohm	
5	**String Voltage**	String Voltage High **142.1**V String Voltage Low **121.8**V	
6	**String Discharge Voltage**	String Discharge Voltage Low default **104.4**V (leave it as default)	
7	**Strap Voltage Drop**	Connection Voltage Drop default **0.050**V (Leave it as default)	
8	**Temperature High**	Temperature High **38.0**°C [**100°F**] * HMI only display/set in Celsius. DTU can display in Fahrenheit	
9	**Battery Capacity**	Battery Capacity, not utilized, not valid, leave it as default	
10	**Designed Runtime**	Designed Runtime, not utilized, not valid, leave it as default	

Continue to **SAVE** changes. [If not saved, the new setting will be lost after power off.]

Please noticed that DTU has separated alarm thresholds which can be adjusted via web interface remotely. For specific implementation, the thresholds on local Sentry unit (can only be changed with HMI) are wider than DTU's. Alarms obtained remotely with SCADA are using DTU's threshold.

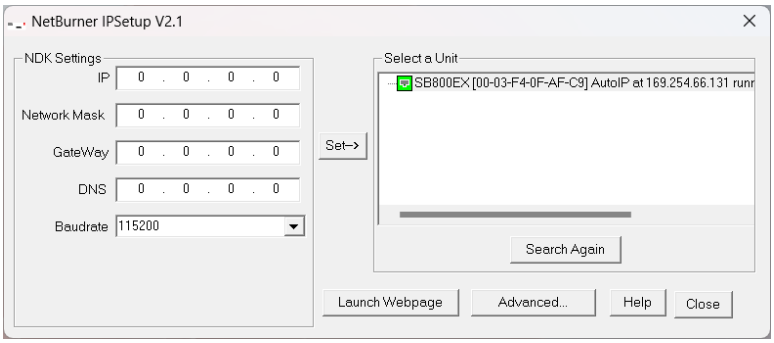
6. DTU Checklist

Laptop Connection

Connect laptop directly to DTU with regular network RJ45 cable.

Run IPSetup.exe. [Available at https://batterydaq.com/tech/ipsetup.zip]

Search for DTU. It shall show DTU with AutoIP. If not, check connection, reboot the DTU by unplug the 12V power plug on DTU. Launch web page with AutoIP.



Alternative Laptop Setting (Not Required)

Connect laptop directly to DTU.
Laptop network settings:
Network and Sharing Center → Ethernet Properties → TCP/IP4 Properties → Set laptop to an IP address.

IP address	192.168.1.100
Mask	255.255.255.0
Gateway	192.168.1.1

In this case, your laptop will act as a router and assign a dynamic IP to DTU, or work with a static IP on DTU. If the gateway settings are different on laptop and DTU, you won't have access to webpage.

Working with Assigned IP

If an IP address has already been set to DTU by client, do NOT change it. Change your laptop network adapter to access DTU.

Example:

	Client's Assigned IP	**Your Network Adapter**	**Note**
IP address	10.16.100.167	10.16.100.100	Must be different
Mask	255.255.255.0	255.255.255.0	Same
Gateway	10.16.100.1	10.16.100.1	Same

DTU Setting Checklist

Item	Description	Check
1	Update firmware with new functions Username: admin Passcode: 7777	
2	Check DTU settings	
3	Check battery alarm settings	
4	Set date/time, save it with code 7778	
5	Clean history with code 75750	
6	Test Data export Add battery info and date to export filename	
7	Set DTU for dynamic IP if cellular modem is utilized. IP address 0.0.0.0 Mask 0.0.0.0 Gateway 0.0.0.0	

Check monitor settings, if DTU only connects to 1 monitor, disable other 2 by setting the address to 0.

Change battery bank name to match the actual site/battery name.

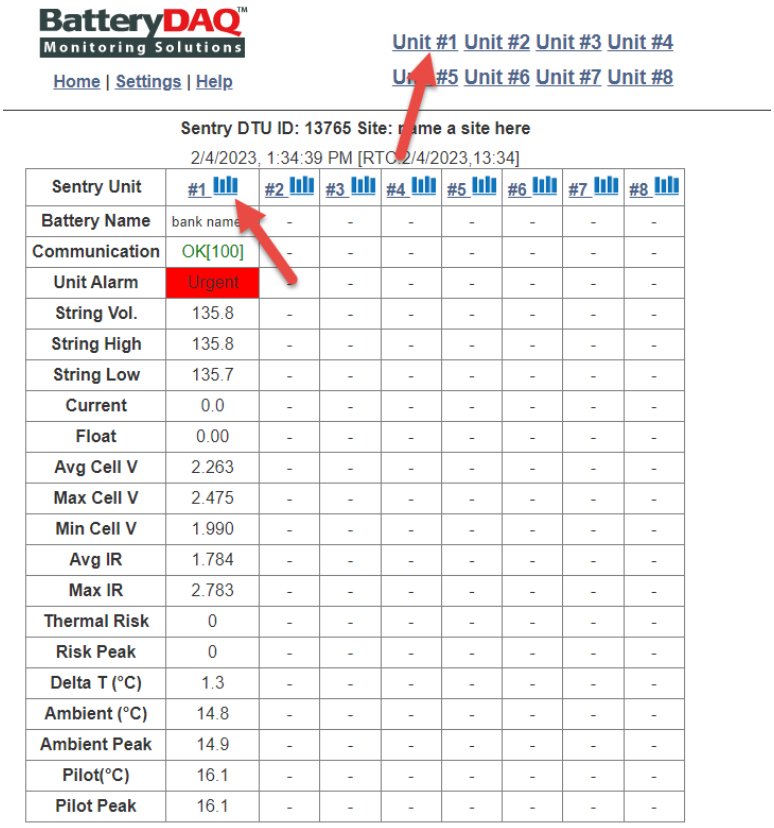
11	Monitor 1 Code	1,2,58,20,10,0,0,2	1,2,58,20,10,0,0,2
-	Battery Bank 1	bank name 1	bank name 1
12	Monitor 2 Code	2,2,58,20,10,0,0,2	2,2,58,20,10,0,0,2
-	Battery Bank 2	bank name 2	bank name 2
13	Monitor 3 Code	3,2,23,20,10,0,0,3	3,2,23,20,10,0,0,3
-	Battery Bank 3	bank name 3	bank name 3

11	Monitor 1 Code	1,2,58,20,10,0,0,2	1,2,58,20,10,0,0,2
-	Battery Bank 1	bank name 1	bank name 1
12	Monitor 2 Code	2,2,58,20,10,0,0,2	0,2,58,20,10,0,0,2
-	Battery Bank 2	bank name 2	bank name 2
13	Monitor 3 Code	3,2,23,20,10,0,0,3	0,2,23,20,10,0,0,3
-	Battery Bank 3	bank name 3	bank name 3

Data Reviewing

DTU main page displays a summary of all connected battery banks.

Click on bar graph image or Unit# to check individual battery bank.

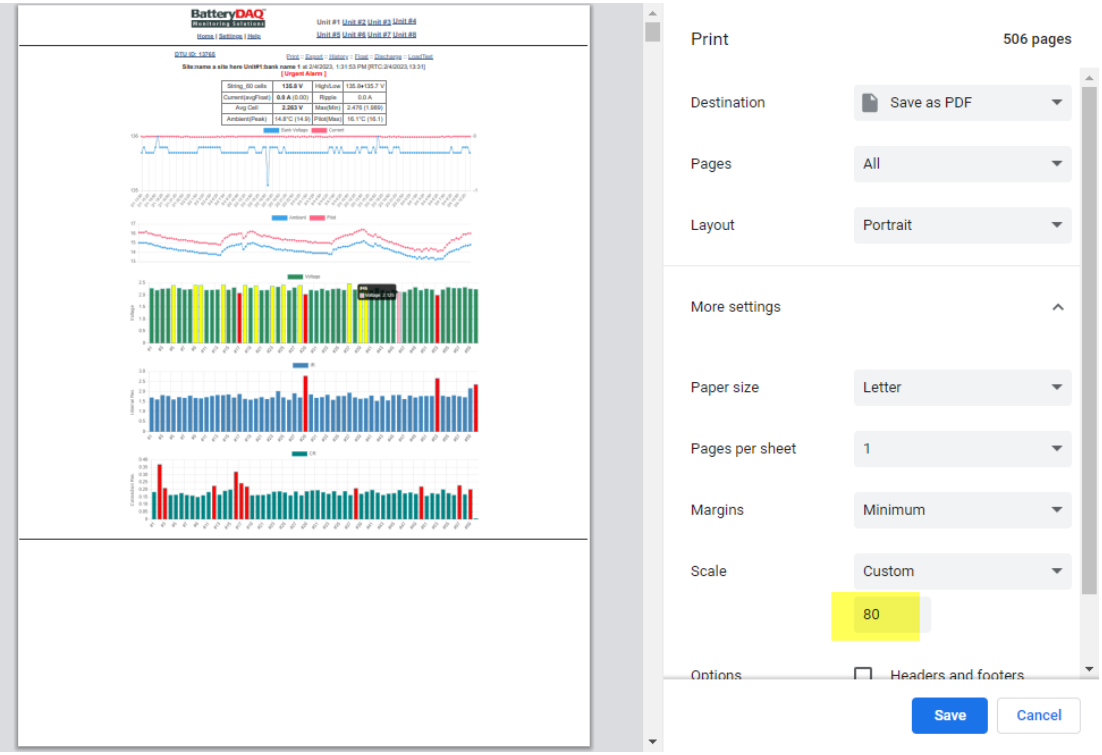


Sentry Unit	#1	#2	#3	#4	#5	#6	#7	#8
Battery Name	bank name	-	-	-	-	-	-	-
Communication	OK[100]	-	-	-	-	-	-	-
Unit Alarm	Urgent	-	-	-	-	-	-	-
String Vol.	135.8	-	-	-	-	-	-	-
String High	135.8	-	-	-	-	-	-	-
String Low	135.7	-	-	-	-	-	-	-
Current	0.0	-	-	-	-	-	-	-
Float	0.00	-	-	-	-	-	-	-
Avg Cell V	2.263	-	-	-	-	-	-	-
Max Cell V	2.475	-	-	-	-	-	-	-
Min Cell V	1.990	-	-	-	-	-	-	-
Avg IR	1.784	-	-	-	-	-	-	-
Max IR	2.783	-	-	-	-	-	-	-
Thermal Risk	0	-	-	-	-	-	-	-
Risk Peak	0	-	-	-	-	-	-	-
Delta T (°C)	1.3	-	-	-	-	-	-	-
Ambient (°C)	14.8	-	-	-	-	-	-	-
Ambient Peak	14.9	-	-	-	-	-	-	-
Pilot(°C)	16.1	-	-	-	-	-	-	-
Pilot Peak	16.1	-	-	-	-	-	-	-

Print to pdf

After finishing installation, right-click web page for each bank to print a set of data and graph as pdf. Name it correctly for archive and commission report.

Set the scale to 80 (80%) so all graphs will be printed within the page width.



7. Installation Report

(Modify this report if necessary)

Client Name:	Client Representative:
Installation Address:	Installer: Date:
Site Name:	DTU ID:
Static IP: Mask: Gateway:	Sentry Monitor Serial No:
Battery type/Model:	Capacity: Ah
Cell Voltage: V	Battery Number in This String:
Bus Voltage: V	Designed Maximum Current: A

Current Measurement

Current Sensor Type	**CT1 Offset**	**CT1 Gain**	**Ripple Offset**	**Ripple Gain**
Shunt SSA-250 ☐ Hall SCY-10-300Q ☐				
Re-calibration (if performed)		**Do Not calibrate**		**Do Not calibrate**

Temperature Calibration

Sensor	**Ambient T0**	**Pilot T1**	**Pilot T2**
Offset			

Voltage Measurement

Factory Voltage Gain	**Re-calibration Gain (if performed)**

Sample		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Cell #	String										
Hand Meter											
Sentry Readout											
Difference											

Internal Resistance Measurement

	IR-1	IR-2	IR-3	IR-4	IR Gain
Cell#					
Before calibration					
Handheld Readout					-
After calibration					

Alarm Threshold Setting with HMI

Parameters	Low Value	High Value	Note
Cell Voltage Abnormal			
Cell IR Threshold (Absolute setting with HMI to Sentry)			
Cell IR Abnormal (Percentage setting to PC software)	N/A		
Bus Voltage Abnormal			
Discharge Current	N/A		
Charge Current	N/A		
Temperature Alarm			

DTU alarm setting

Copy from DTU alarm setting page

Screen capture for Voltage/IR/CR graph

Data Export

Save to file with site_battery_date information.

Other Notes